

Stand-Alone Worksheets for Basic Mathematical Computation Skills Development

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The Asian Conference on Education 2020
Official Conference Proceedings

Abstract

The recent National Achievement Test (NAT) results proved the mathematics performance of Filipino learners fall below the DepEd's 75% MPS target. Additionally, international assessments including TIMSS and PISA revealed similar poor results of Filipino students in math. This study developed "Stand-alone Worksheets" (SAWs) to address least mastered computation skills; it revealed the developed Grade 6 basic mathematical computation skills preparatory to Grade 7 and performance gains of the mathematically challenged Grade 5 completers along basic mathematical computation skills. A one-group pre-test and posttest pre-experimental design was used in this study. There were 880 pupils from three (3) representative large schools in Albay of S.Y. 2018-2019 screened from where the lowest 25% participants were taken. Fifteen (15) worksheets were developed covering multiple operations on whole numbers, estimations and four basic operations on fractions and decimals. The SAWs increased the pupils' performance. The said improvement is statistically significant at $\alpha = 0.01$. Further, the SAWs can be adopted and/or modified to enhance learners' performance level, and that teachers should focus on deepening pupils' conceptual understanding of basic computation skills. This paper suggests that a better mathematical performance is achievable in both primary and secondary levels when teachers focus on developing basic math skills among students.

Keywords: Basic Computation Skills, Conceptual Understanding, Primary Math Education

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Introduction

Even with the presence of digital mathematical devices which can perform various mathematical procedures, basic foundation skills in math remain integral parts of learner's mathematics education because they lay the foundation for success in learning higher mathematics (Harris, 2017). In general, every citizen needs to have a strong mathematical background to be able to pursue higher education and eventually, thrive in a highly technological workplace. However, over the past years in the Philippines, the National Achievement Test (NAT) results of primary Filipino pupils in math remained low (Philippine Statistics Authority, 2016). Recently, in 2018, the country also participated in an international benchmark assessment of PISA in reading, mathematics and science. Unfortunately, the results were as frustrating as the country ranked the lowest among the 79 participating countries in reading comprehension and ranked second to the last (78th) in mathematics and science (BusinessWorld, 2019). The Philippines was outperformed greatly by its neighboring Asian countries such as China, Japan and Singapore among others.

Basic computation is one of the predominant competency areas in primary mathematics curriculum. It comprises the most salient foundational competencies such as basic arithmetic, conversions, estimations, and rounding off rational numbers. These skills are entrenched in the primary math curriculum along Numbers and Number Sense Strand which "focuses on learners' understanding of numbers such as counting numbers – whole numbers, integers, fractions, decimals, real numbers and complex numbers, properties, operations, estimation and their application to the real-world situations" (SEI-DOST&MATHTED, 2011). Developing such skills among primary learners should be a priority of primary mathematics teaching if the goal is to augment students' performance in the subject. More specifically, maintaining the need to increase the performance of secondary students in math, early proficiency assessments on these skills among pupils who are moving to the secondary level (upper elementary i.e. Grade 4, 5 and 6) and providing interventions which could create a positive impact on the current math performance status of Filipino students is an imperative. This research developed intervention materials that address least mastered skills along numbers and number sense strand in primary mathematics.

Table 1. Least Mastered Skills in Grade 7 along Numbers and Number Sense and their Prerequisite Skills

Commonly Least Mastered Skills in NAT	Least Mastered Skills among the Respondents which are Prerequisites in Grade 7 Competencies Along Numbers and Number Sense	
Grade 7	Grade 6	Grade 5
Operations on whole numbers and rational numbers: integers, decimals, fractions and percent	<ol style="list-style-type: none"> 1. Performs basic operations on integers 2. Performs series of operations following GEMDAS rule 3. Estimates sums and differences of fractions and decimals in simple and or mixed form 4. Adds and subtracts fractions in simple mixed forms with or without regrouping 5. Adds and subtracts decimals and mixed decimals through the thousandths with/out regrouping 6. Estimates products of whole numbers, fractions and decimals 7. Multiply fractions in simple and mixed forms 8. Multiplies decimals and mixed decimals through thousandths with/out regrouping with zero difficulty 9. Estimates quotients of whole numbers, fractions and decimals 10. Divides fractions and decimal numbers in simple and mixed forms 11. Divides whole numbers (2-5digits) by decimals (1-2digits) 12. Divides mixed decimals by whole numbers 13. Divides whole numbers by mixed decimals 14. Divides mixed decimals by mixed decimals 15. Divides decimals by 	<ol style="list-style-type: none"> 1. Simplifies a series of operations on whole numbers involving more than two operations using the PMDAS/GMDAS rule. 2. Estimates sums, and differences, products and quotients of fractions and mixed numbers 3. Adds fractions and mixed numbers with/out regrouping 4. Subtracts fractions and mixed numbers 5. Multiplies a fraction and a whole number and another fraction 6. Divides, simple fractions; whole numbers by a fraction and vice versa 7. Estimates the sum or difference of decimal numbers 8. Adds and subtracts decimals through thousandths with/out regrouping 9. Adds and subtracts mixed decimals with/out regrouping 10. Estimates products of decimal numbers 11. Multiplies decimals by multiples of 10 and 100 12. Multiplies decimal numbers of values up to hundredths 13. Multiplies mixed decimals with tenths and hundredths by whole numbers 14. Multiplies mixed decimals by mixed decimals with tenths and hundredths 15. Estimates the quotients of decimal numbers 16. Divides decimal numbers by whole numbers 17. Divides decimal numbers of

powers of ten 16. Computes common percentage problems	values up to hundredths 18. Finds percentage in a given problem
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The continuous decline of NAT results of the Filipino students has triggered reforms and innovations in mathematics curriculum, and driven numbers of researches aimed at reducing the ripple effects (Mirabueno, 2019). However, recent report of DepEd Regional Office 5 informs that the Bicolano students' performance remained low in the subject. This said report presented a summary and interpretation of the NAT results and noted the hard-to-teach, and least-learned competencies in both primary and secondary mathematics. This information formed the baseline data of this study and strengthened the need to conduct an assessment and early intervention. Cawley and Miller (1989) cited that while it is likely that the curriculum may account for some achievement deficits, learning gaps of students may actually be due to intrinsic factors and are not solely caused by poor teaching or curriculum design. Hence, this study developed and validated worksheets specifically designed to fit the needs of the respondents. Each worksheet embeds a set of basic computation skills which is geared towards proficiency.

Table 2. Developed Skills and Competency Rating by School by Competency Area

Area	Competency No.	Pre-Test				Post-Test			
		Schools			Row Mean	Schools			Row Mean
		F	I	J		F	I	J	
Whole Number	Simplifies a series of operations on whole numbers involving more than two operations (Comp 1)	10.	29.	16.	19%	39.	38.	34.	37%
		9	4	7		13	2	4	
Fraction	Estimates sums, and differences, products and quotients of fractions and mixed numbers (Comp 3)	10.	20.	11.	14%	33.	17.	31.	28%
	Adds fractions and mixed numbers with/out regrouping (Comp 4)	8.7	19.	0	9%	20.	37.	20	26%
	Subtracts fractions and mixed numbers (Comp 5)	0	2.9	0	1%	19.	29.	23.	24%
	Multiplies a fraction and a whole number and another (Comp 6)	0	5.8	0	2%	34.	29.	33.	33%
	Divides simple fractions, whole numbers by a fraction and vice versa (Comp 7)	0	5.8	10	5%	23.	88.	26.	46%
Decimal	Estimates the sum or difference of decimal numbers (Comp 8)	15.	29.	10	18%	26.	94.	23.	48%
	Adds and subtracts	15.	11.	28.	18%	29.	64.	38.	44%

decimals and mixed decimals through thousands with/out regrouping (Comp 9)	2	8	3		3	7	3	
Estimates products of decimal numbers (Comp 10)	10.9	8.82	10	10%	47.8	64.7	53.3	55%
Multiplies decimals by multiples of 10 and 100 (Comp 11)	13.0	0	6.67	7%	32.6	47.1	46.7	42%
Multiplies decimal numbers of values up to hundreds (Comp 12)	23.9	0	6.67	10%	26.1	64.7	50	47%
Multiplies mixed decimals with tenths and hundreds by whole numbers (Comp 13)	10.9	5.88	10	9%	45.6	29.4	43.3	39%
Multiplies mixed decimals by mixed decimals with tenths and hundredths (Comp 14)	13.1	20.6	20	18%	26.1	20.6	36.7	28%
Estimates the quotients of decimal numbers (Comp 15)	10.9	2.94	16.8	10%	23.9	20.6	40	28%
Divides decimal numbers by whole numbers (Comp 16)	15.2	14.7	26.7	19%	23.9	35.3	30	30%
Divides decimal numbers of values up to hundredths (Comp 17)	17.4	14.7	20	17%	26.1	23.5	16.7	22%

Conclusions

Based from the results of the study, it can be inferred that the respondents were able to develop the basic computation skills which are prerequisites of higher mathematics by the use of stand-alone worksheets. This effect proves that the said materials were adequate and effective in increasing learner's performance. However, although such increase is statistically significant, performance rating of the respondents per competency has not met the 75% cut-off score. This condition suggests that further assessments should be done to monitor the learners' learning progress and teachers and/or researchers should further conduct interventions. In addition, materials to supplement instructional tools other than worksheets should also be developed and employed. This can be those which engage and allow learners to use multiple senses. This further implies that teachers need to demonstrate flexible and effective teaching methodologies, strong classroom organization and management skills in order to ensure that the students learning needs are appropriately addressed.

Acknowledgements

I offer my deepest gratitude to the many people who extended great help during this hurdle; to the Department of Science and Technology-Science Education Institute, for financing this study, Professor Richard M. Lorente, my thesis adviser, Professor Ma. Carolina L. Boyon, my statistician and editor, to my parents, Jaena and Jovic Sr., and to all others whose names I failed to mention for without their collective efforts, this wouldn't be a success.

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